Section III Existing Conditions of Ecological Resources

Overview

Lebanon Hills Regional Park displays a very diverse, interesting, and unique natural landscape character. As a regional park exhibiting an array of landscapes ranging from moraine hills to lakes and ponds, land stewardship, ecological preservation, and water resources management are all high on the priority list. This section provides an overview of the ecological resources of the park, and sets the stage for Section IV, which provides a framework for ecological stewardship.

Extent of Evaluation Conducted

The ecological and land cover information and mapping presented in this section was prepared for master planning purposes and to establish an underpinning for the ecological stewardship plan defined in the next section. To aid the planning effort, field reconnaissance was conducted by ecologists, foresters, botanists, landscape architects, and complementary professionals to discover the condition of the park and ecological issues being faced. Although much has been learned about the park, there is also much to learn about its ecological systems. The information presented here serves primarily as a primer for developing a stewardship program that is specifically tailored to the scientific nuances and challenges affecting the park.

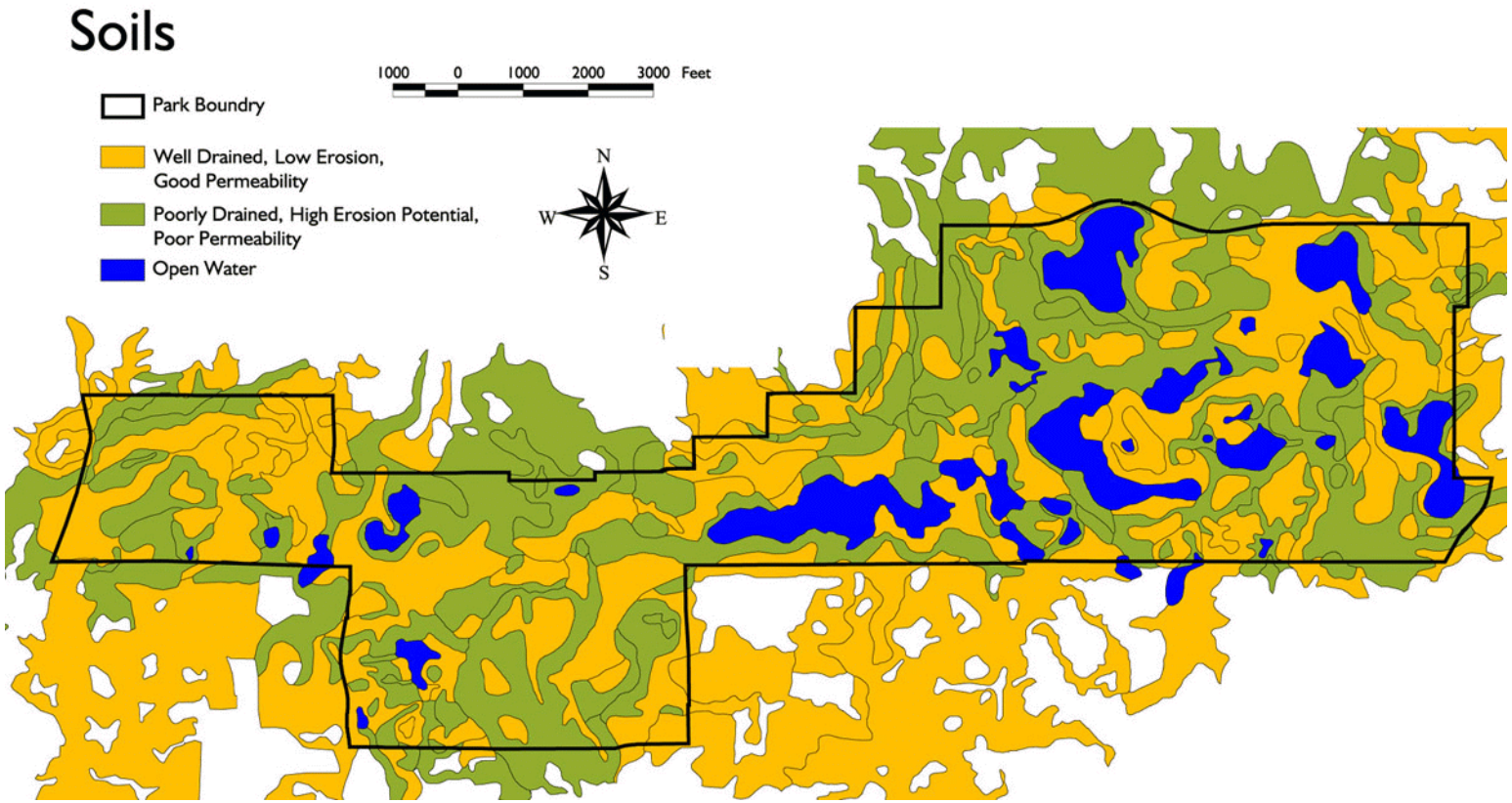
Geology and Large Area Natural Features

As defined in the draft *Comprehensive Natural Resources Management Plan for Dakota County Parks* dated June 2000 (Natural Resources Plan), the park consists of a couple of dominant natural features: glacial moraine hills and kettle hole lakes and Ponds. The following is an excerpt from the Natural Resources Plan that describes these features.

Glacial Moraine Hills: Lebanon Hills Regional Park and its surrounding area is dominated by a glacial moraine landscape. The moraine landscape exhibits hills, ridges, and depressions with configurations that are often unusual and unpredictable. The hills for which the park is named adds to the beauty of the landscape but also often provide a challenge for routing trails and siting use areas. Soil types across the park are complicated. Unlike glacial outwash plains that contained soil particles of similar size, glacial moraine soils generally contain soil particles that are not sorted by size. A moraine soil could contain clay particles, silt, sand, gravel, rocks, and boulders all mixed together. A good share of the soils in the park are mapped as the Kingsley-Mahtomedi-Spencer complex, which consists of a sandy loam with variable underlying material, a loamy sand underlain by gravelly sand, and a silt loam underlain by a silty clay loam. Within this soil complex, individual soil areas are so small and form such an intricate pattern that it was not practical for the County Soil Survey to map them separately. Due to the complicated nature of the soils types found across much of the park, erosion control, vegetation management, and development of use areas and trails is often challenging. Figure 3.1 provides an overview of soil characteristics found across the park.

Due to the complicated nature of the soils types found across the park, erosion control, vegetation management, and development of use areas and trails is often challenging.

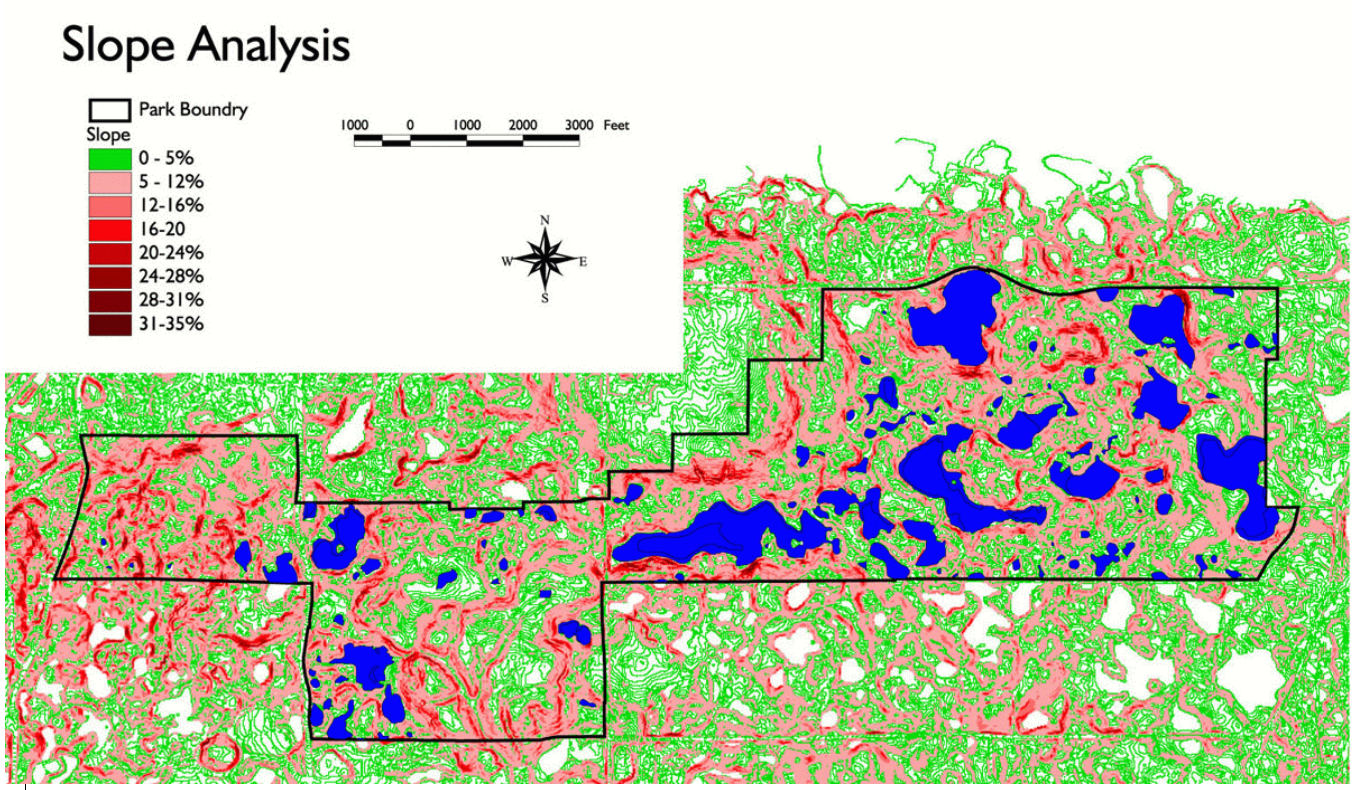
Figure 3.1 – Soil characteristics found across the park.



Kettle Hole Lakes and Ponds: A glacial moraine landscape usually contains many rounded depressions called "kettle holes". Many of these depressions are normally filled with water. As figure 3.1 illustrates, this is certainly a characteristic of Lebanon Hills. The park contains many such water basins, with 13 lakes and ponds each covering more than 10 acres in area. Dozens of smaller ponds also dot the landscape. These abundant surface water resources enhance the beauty of the park and provide habitat for fish and wildlife.

As would be expected with a glacial moraine landscape, topographic changes across the site area also very pronounced. As figure 3.2 illustrates, steep and unpredictable slopes are a major landscape feature of the park.

Figure 3.2 – Slope characteristics found across the park.



Overview of Current Ecological Systems

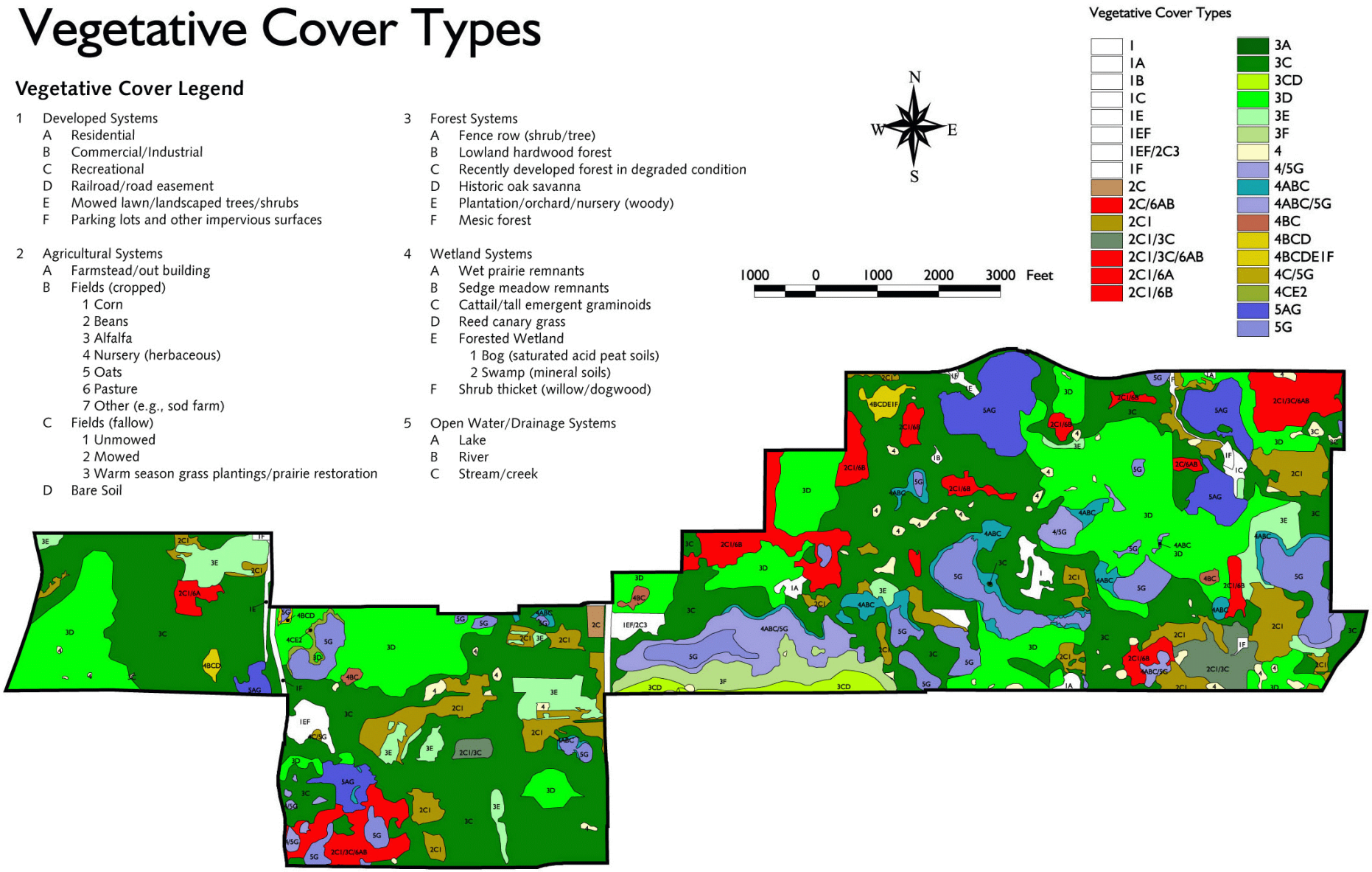
The ecological and vegetative communities found within the park are those that are adaptable to the local soil conditions, hydrologic patterns, and climate (macro and micro). Plant communities ranging from oak savanna and prairie to wetlands and bogs have all been historically present in the park.

Ecological systems found within the park (excluding developed and agricultural systems) were divided into four general categories:

- Forest Systems
- Upland Prairie Systems
- Wetland Systems
- Open Water Systems

These categories capture the essence of the natural plant communities and ecological systems historically and currently found within the park. Note, however, that within each category there are numerous subcategories and levels of scientific detail that need to be considered as specific plans for restoring and managing natural plant communities are implemented. Figure 3.3 provides an overview of the land cover mapping of these systems.

Figure 3.3 – Land cover mapping of the park's prevalent ecological systems.



The vegetative land cover mapping shown in figure 3.3 represents the findings of field reconnaissance that was conducted in the fall of 2000 to discover the general condition of the park and ecological communities. This investigation proved fruitful in documenting the existing conditions found across the site and the ecological issues being faced. In addition, field investigation was augmented by using existing natural resource inventory data for the park. This included the following mapping and reports:

- Minnesota County Biological Survey (MCBS);
- Minnesota Natural Heritage Information System (MNHIS);
- Minnesota Land Cover and Classification System (MLCCS);
- National Wetlands Inventory (NWI);
- Soil Survey of Dakota County;
- Park-specific reports developed by Dakota County Parks.

Although a more thorough inventory entailing more extensive field inventory work and ground-truthing is needed to develop and implement the stewardship program, the information obtained about the park thus far proved valuable at a master planning level. The following considers the general condition of the predominant vegetative communities found within the park.

Forest Systems

Several types of natural forest communities are found throughout the park system and are summarized as follows.

Recently Developed Forest in Degraded Condition: These systems are comprised of the early invading species such as cottonwood, box elder, green ash and red elm. These areas typically occupy fallow fields, former wetland soils that had been drained and fallowed from agricultural land uses for 20-50 years, spoil piles along ditches/creeks/dikes, and wetland and pond margins where successional tree species have invaded and caused shade suppression of the native, soil-stabilizing vegetation. In almost all cases where the early successional forest trees have developed, the ground cover vegetation system has collapsed and is represented by only a few shade tolerant species. Often the canopy, which is usually closed, includes dense growths of European buckthorn and other shrubs that are semi- to completely shade tolerant. The influence of shading by young trees and buckthorn has contributed to the decline of the native, soil-stabilizing vegetation. These are typically depauperate (stunted), low diversity, unstable systems, whereby many of the early successional species found there have short life spans and are beginning to show major senescence or mortality, particularly red and Siberian elm and boxelder. Where this vegetation occurs along the streams or wetlands it will contribute substantial woody debris to the adjacent aquatic systems, which contributes to bank erosion, log jams on water bodies at outlet structures, and other aquatic maintenance issues that are costly and preventable.

Recently developed forest in degraded condition is commonly found in the park. As shown, buckthorn is taking over the understory.

Lacking management, the mature oak savanna systems are being replaced by a dense understory of shrubs and trees.

Most of the park's historic oak savannas have experienced severe degradation where substantial erosion of the topsoil has occurred due to lack of ground cover vegetation.

Aggressive stewardship is needed to retain the beauty of the oak savanna systems in the park.

Historic Oak Savanna: Historically, these areas consisted primarily of Dry Oak Savannas (Minnesota Department of Natural Resources (MDNR) Natural Community classification). Dry Oak Savannas are typically dominated by bur oak, northern pin oak, and native and introduced forbs, grasses, sedges, and shrubs. These historic oak savannas exist in several areas of the park and are typically found on higher and drier topographic benches with excessively- to well-drained sand to loam soils, usually on south and west exposed sites. On north exposures, particularly south of Jensen Lake, Mesic Deciduous Forest species such as red oak, basswood, birch, and ironwood are present in protected and down slope areas, while upper slopes are vegetated with Historic Oak Savanna.

In most instances, the historic character of these oak savannas has been lost to varying degrees due to either lack of natural disturbances (e.g., fire) and/or lack of management. Historic oak savanna areas within the park are currently characterized by relatively isolated oaks to larger groves of oaks growing within an often dense canopy of other tree and shrub species. Understory vegetation, formerly consisting of native prairie, has been invaded and replaced by species such as European buckthorn, boxelder, quaking aspen, large-toothed aspen, black cherry, and choke cherry. The resulting shade suppression has greatly reduced the existing ground cover and native understory vegetation. Many of the historic savanna areas have very little ground cover vegetation, and woody vegetation is entirely dominated by European buckthorn. Scattered light gaps in the canopy enable patches of certain species to grow, including red maple saplings, cluster-leaf tick-trefoil, Pennsylvania and other upland sedges, common enchanter's nightshade, false Solomon's seal, and thimbleweed. Other species found in the understory of these historic savannas include grape-woodbine, rough bedstraw, frost-grape, Missouri gooseberry, stinging nettle, and bland sweet cicely.

Most of the park's historic oak savannas have experienced severe degradation where substantial erosion of the topsoil has occurred due to lack of ground cover vegetation. Topsoil loss is associated with the loss of the long-lived seeds, roots, tubers, bulbs, and other plant stock from the soil. Substantial alluvial fans and pedestaled root systems are present in the park, documenting the severe nature of erosion in some cases. Substantial tree mortality has resulted in these areas, including significant oak decline. Significant dieback was also observed on lower branches of bur oaks from the dense shading caused by the associated overstocked canopy. However, in several areas (e.g., the fringes of prairie remnants) oak regeneration was observed to be occurring, suggesting that, through proper management, oak savanna systems can be reinvigorated in the park.

The deterioration of the park's oak savannas follows a process of degradation that has been documented by previous studies throughout the upper Midwest. The results of such trends include a precipitous decline in native vascular plant and breeding bird species richness, severe erosion, and reduced opportunity for restoring these savanna systems with increasing time since the onset of erosion and soil seed bank loss. Prompt attention should be given to halting and reversing this trend of degradation by implementing a well thought-out restoration and management program.

The lack of a vibrant groundcover in the mesic deciduous forest results in severe washouts and gullies, which leads to sedimentation of downstream lakes and ponds.

European buckthorn and other aggressive species have invaded portions of this mesic forest, resulting in areas of shade suppression.

Management of the prairie systems is needed to forestall the invasion of less desirable species, such as the Siberian elm trees in the background.

Mesic Deciduous Forest: This forest system was identified in only one portion of the park – on the north-facing slope just south of Jensen Lake. The Minnesota County Biological Survey (MCBS) identified this area as "Oak Forest – mesic subtype". Identification of an area by the MCBS indicates that it is representative of a "natural community" – a group of native plants and animals that interact with each other and their abiotic environment in ways not greatly altered by human activity or by introduced organisms (Natural Communities and Rare Species of Dakota County, Minnesota, 1997) . The north-facing slope and proximity to a water body have helped protect this community from fire, resulting in a more diverse assemblage of tree, shrub, and herbaceous plant species when compared to oak savannas. The canopy is typified by 40 to 70 year old red oak, paper birch, sugar maple, and red maple. Ironwood is well represented in the understory, and the ground cover includes early meadow-rue, lopseed, cluster-leaf tick-trefoil, wild sarsaparilla, zigzag goldenrod, and red-berried elder (in drainage swales).

European buckthorn and other aggressive species have invaded portions of this mesic forest, resulting in areas of shade suppression. This phenomenon results in reduced ground cover vegetation and limits the potential for native plants to compete with invading species. Lack of healthy ground cover vegetation in conjunction with the moderate to steep slopes in this portion of the park leaves these areas subject to severe erosion. This erosion not only exposes root systems and removes native seeds and other propagules, but also results in down slope deposition, which may either smother native upland soils or cause sedimentation in lakes, ponds, and wetlands.

Most, if not all, of the trees within the Mesic Deciduous Forest were found to be comprised of age classes that post-dated settlement of the region in the 1830's and 40's. A lack of tree regeneration, particularly oaks, was observed in this forest type. No pre-settlement trees were identified within this forest.

Through a well thought-out restoration and management plan, many of these forest systems can be restored to represent more closely their pre-disturbance condition.

Upland Prairie Systems

Remnants of both mesic and dry prairie are scattered across Lebanon Hills Regional Park. Numerous prairie remnants of varying quality and size were identified within the park, usually on south- or west-facing slopes. The species composition of two larger prairie remnants was documented within the park: 1) an area extending south and east from the Parkview Golf Club, and 2) in an old field near a sandpit.

The prairie remnant adjacent to the golf course contains large stands of little bluestem, panic grass, tumble grass, and bush clover. Many weeds exist in this remnant, including Kentucky bluegrass, Canada bluegrass, grape woodbine, and common yarrow. Woody invasion is also occurring here, including sumac, black cherry, boxelder, and Siberian elm.

As opposed to a monotypic plant structure (limited diversity), restoring native prairies can reintroduce diverse systems that offer color, contrast, biodiversity, and habitat to the site.

The latter prairie remnant near the sandpit was identified by occasional scattered native prairie species such as Indian grass, flowering spurge, black-eyed Susan, bush-clover, blue vervain, wild bergamot, and showy goldenrod. This remnant is dominated by quack grass and Kentucky bluegrass and contains a lesser amount of common sorrel, ragweeds, Canada goldenrod, common yarrow, sulphur five-fingers, strawberry-weed, butter-and-eggs, and hoary alyssum. Due to the absence of regular fires, this remnant is undergoing woody invasion by species such as common blackberry, boxelder, black cherry, and staghorn sumac.

In general, other areas identified as prairie remnants varied from sites with a few remaining plants of one or more prairie species (often Indian grass or big bluestem clumps, bergamot, or flowering spurge remained), to slightly larger areas with some continuous cover by these or other prairie species. All remnants were relatively small and most were isolated with woody vegetation encroachment occurring.

Most of the park's prairie systems have suffered degradation by following one of two pathways: either the absence of fire and other natural disturbances has resulted in woody invasion, which shades and out-competes most native prairie species, or the prairies were previously cropped. The first scenario of woody invasion is typified by sparse native prairie grasses and forbs with an increasing component of invasive woody species such as sumac, Siberian elm, black cherry, and boxelder. The second scenario of formerly cropped prairies generally results in old fields dominated by introduced naturalized grasses and forbs, many of which are typical weed species associated with disturbed landscapes (e.g., smooth brome, quack grass). Native plant species found in the old field settings are infrequent and typically are those that are most tolerant of disturbance. Most old fields within the park are also experiencing woody invasion.

In most cases, these prairie remnants can be restored to healthy native prairie systems.

In most cases, these prairie remnants can be restored to healthy native prairie systems. The appropriate combination of woody species removal, prescribed burning, and interseeding can often restore these prairies with moderate effort.

Wetland Systems

Wetlands within the park vary from expansive lake fringes (e.g., Jensen Lake), to the numerous, isolated, glacial potholes found mostly in the eastern half of the park, to the tamarack swamp located in the northern portion of the park. Many of the park's wetlands contain remnants of wet prairie and/or sedge meadow, and the tamarack swamp was identified by the MCBS as "Tamarack Swamp – minerotrophic subtype".

In all locations observed, the "ecotone", or transition zone, between wetlands and the adjacent upland system have been seriously degraded.

In larger wetland areas and in areas not subjected to major hydrologic changes or watershed degradation, pockets of diverse wetland plant communities are occasionally found; but these are rather isolated occurrences. In all locations observed, the "ecotone", or transition zone, between wetlands and the adjacent upland system have been seriously degraded.

Most of the wetland systems have been compromised within the park, largely due to excessive fluctuation in water levels and hydrologic patterns.

Tremendous opportunities for wetland restoration exist within the park. Primary consideration needs to be given to returning the hydrology of these systems to a more natural condition.

It appears that degradation of open water systems within the park is due primarily to the significant volumes and volatility of urban stormwater entering the park and the management of this stormwater.

Most of the park wetlands have seriously deteriorated due to stormwater management within the park and the spread of invasive species. Most wetlands examined have been significantly modified through ditching, diking, or other alterations to water level dynamics. Stormwater runoff and management impacts are characterized by volatile changes in water levels and excessive nutrient and sediment loading. Dead and dying fringing trees around wetland perimeters (resulting from severe water level fluctuations) and movement of invasive species into these areas and beyond characterize some of the problems where wetlands have been used for stormwater management. Many of these wetlands with disrupted hydrology are dominated by aggressive plant species (e.g., monocultures of southeast Asian reed canary grass and cattails), which are resistant to significant water level fluctuations and are often indicative of higher nitrogen, phosphorus, and potassium levels. The aggressive, invasive nature of these plants leads to reduced species diversity and loss of desirable native plants and animals. Even the tamarack swamp has been degraded by invading reed canary grass, cattails, and glossy buckthorn.

Significant changes in nutrients and biogeochemical cycling in the park wetlands was apparent. Urban stormwater runoff is contributing sediments, nutrients, and other contaminants into the park's wetlands. Deposition of eroded soils from surrounding, often steep, shade-suppressed, upland forested slopes was also observed in several areas of the park. In areas where the groundwater level in wetlands may have been lowered, decomposition and the liberation of nitrogen, phosphorus, and other nutrients into waterways is occurring. Although not investigated in this study, the ecological changes observed suggest that the surface water and perhaps shallow water and groundwater chemistry have been significantly altered by the addition of higher levels of macro-nutrients which results in the hypereutrophic conditions (i.e. reduced oxygen levels which favor plant over animal life) of the wetlands and some open water systems.

Tremendous opportunities for wetland restoration exist within the park. Primary consideration needs to be given to returning the hydrology of these systems to a more natural condition. In addition, removal and long-term management of invasive species needs to be initiated in the park wetlands.

Open Water Systems

Open water systems generally include the open-water portion of lakes and deep ponds. These glacial features are typically characterized as rounded depressions termed "kettle holes". The condition of the vegetative communities found within open water systems was not explicitly investigated during the master planning process; however, many of the same factors that have degraded forest, prairie, and wetland systems within the park are contributing to open water system degradation. It appears that degradation of open water systems within the park is due primarily to the significant volumes and volatility of urban stormwater entering the park and the management of this stormwater. However, it is important to note that the open water systems have also undergone degradation due to upland and wetland systems that no longer effectively slow down and infiltrate stormwater before it reaches lakes and ponds. These impacts severely compromise water quality and natural water levels, resulting in nutrient-rich water and a decrease in native vegetative diversity.

One of the most critical factors associated with water quality and shoreline stability is maintaining a viable ecological buffer along the edge.

The quality of the lakes and ponds are being impacted greatly by stormwater management practices and sediment from unmanaged upland areas.

In particular at Lebanon Hills Regional Park, addressing stormwater before it enters the park boundaries is a key to successful restoration of open water and wetland systems.

In addition to the issues associated with healthy vegetative communities, lake and pond edge stability and water quality are also important ecological concerns worth highlighting. With respect to all water bodies, one of the most critical factors associated with water quality and shoreline stability is maintaining a viable ecological buffer along the edge to slow down stormwater runoff, capture macro-nutrients, and infiltrate water before it reaches the open water. As mentioned in the wetlands discussion above, trees and other native vegetation along the shorelines of many of these Open Water Systems have died due to severely fluctuating water levels. What often results are poorly vegetated banks providing little buffering, or stands of invasive species.

With most of the lake and pond systems within the park being relatively shallow, they likely do not have a high potential for producing fishing opportunities. These same systems dry down infrequently, and during a dry warm summer they become very shallow, warm, and likely anoxic. A few lakes in the park have sufficient depth to provide a fishing opportunity. This suggests that most shallow lakes may best be restored to healthy wetland and shallow pond systems, and the deeper lakes could continue to support a fishing use. Restored open water systems and wetlands could also be used for reintroduction of rare fish species that would have historically been present in these habitats. These fish may have been extirpated because of surrounding urbanization trends or the past draining of some of the park's aquatic systems for agricultural use.

In particular at Lebanon Hills Regional Park, addressing stormwater before it enters the park boundaries is a key to successful restoration of open water and wetland systems. Reduction or removal of these off-site stormwater inputs in conjunction with upland and wetland restoration efforts within the park should greatly increase water quality and enable more natural water levels to exist in the park's aquatic systems.

Conclusions Regarding Current Ecological Condition

Although Lebanon Hills Regional Park represents an impressive assemblage of natural resources, the vast majority of these systems have undergone severe degradation over the past several decades. A comprehensive restoration and management program is needed if natural communities, such as oak savannas, prairies, and aquatic resources are to be restored.

Related Threats to Ecological Systems

In addition to concerns about the vegetative communities in the park, there are a number of other threats to the ecological systems in the park. The following considers the most important ones.

Internal Development-Related Threats

Although development for recreational and educational purposes is a fundamental role of the park, it can also pose certain threats to ecological systems if not done well. One of the biggest threats associated with development is erosion. As the following photos illustrate, erosion can cause significant environmental impacts if left unchecked.

"Blowout" of a culvert after a major storm occurs when normal water flows are interrupted. Instead of a culvert, a short bridge crossing may prevent this from occurring in the future.

Trails that are steep and poorly placed tend to serve as the drainageway after a heavy storm, often leaving big eroded channels in the trail that require additional maintenance and cause sediment to flow into ponds and lakes.

Entrance road to Schulze Lake is prone to flooding.

Large parking lot by Schulze Lake generates significant unchecked runoff.

In addition to trail-related conditions, other built factors contribute to ecological concerns in the park. As an example, the large parking lot near Schulze Lake generates a significant amount of unchecked water flow, which tends to aggravate stormwater management issues. Another example is the entrance road to this area that is built through a historic wetland and ponding area and is now prone to flooding. By paying more attention to the potential ecological impacts associated with development, future problems can be averted. The photos on the left highlight these examples.

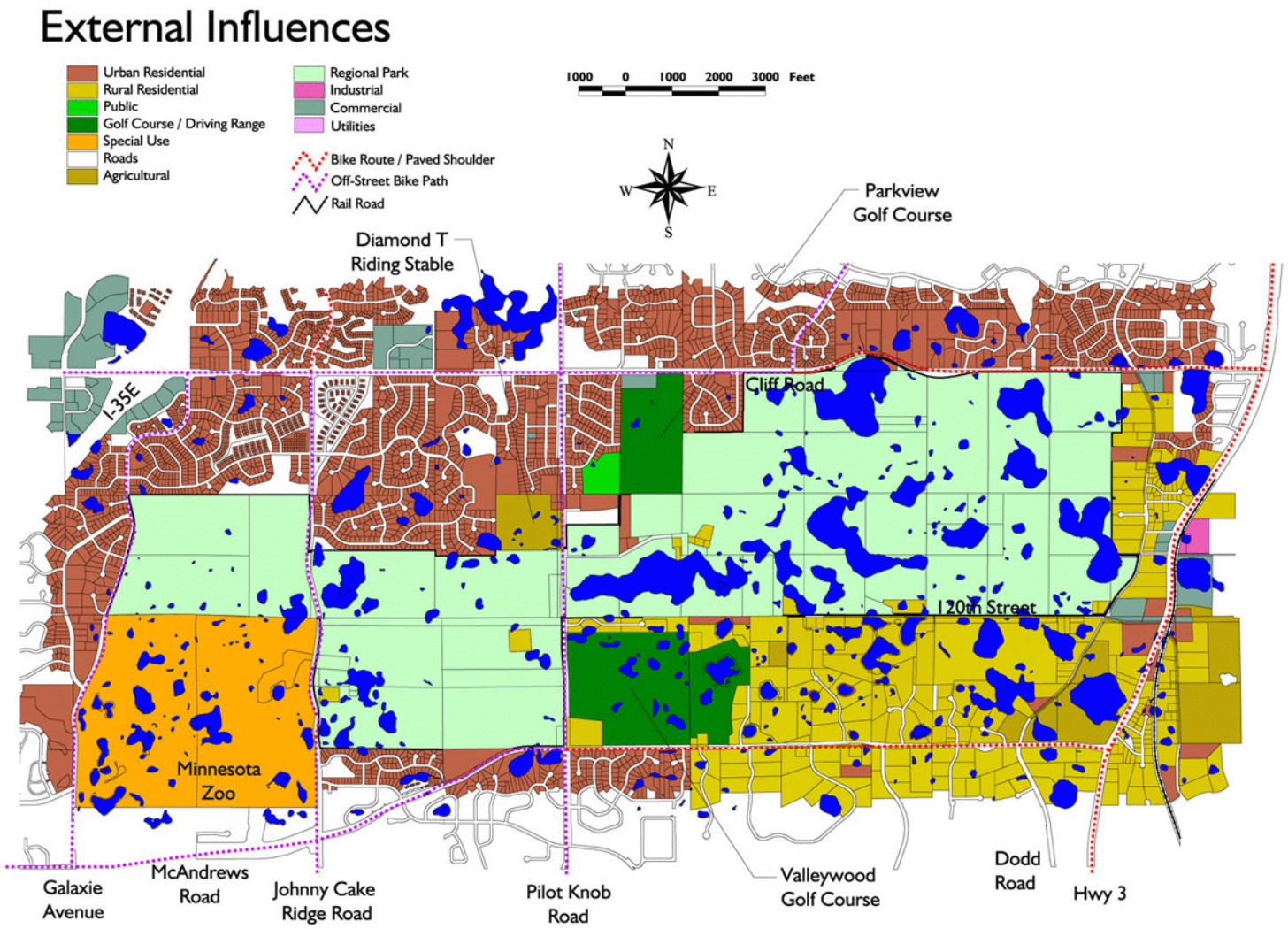
As the photo on the right illustrates, simple overuse of trails can cause ecological concerns. In these instances, a more stable trail bed will be needed to forestall continued degradation and "trail creep".

Trails creep is occurring to the right of the main trail around Jensen Lake. This happens when the trail bed is unstable during wet periods and people go off it to higher ground.

External Development-Related Ecological Impacts and Water Resources Management Issues

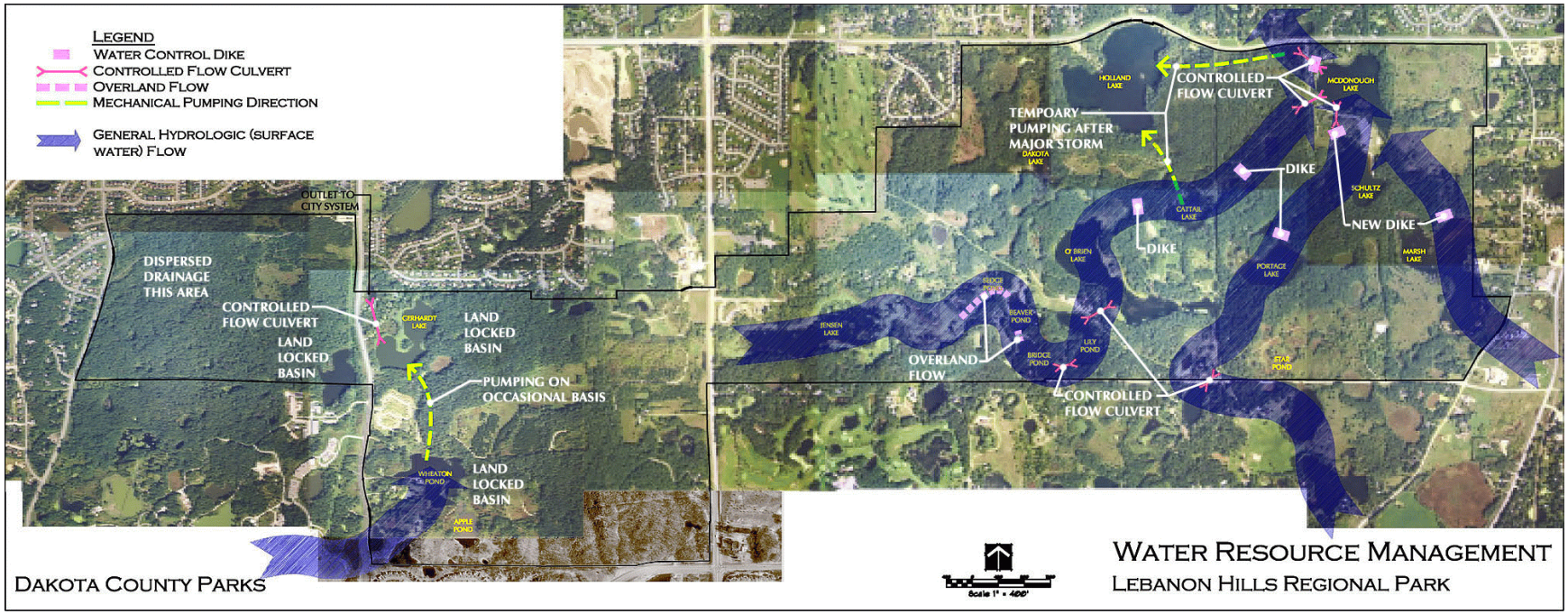
External development and water resources management issues have also had a great influence on the ecological systems within the park. As figure 3.5 illustrates, much of the land external to the park has been developed or otherwise used for various purposes, ranging from golf course to horse stables.

Figure 3.5 – External influences on the park.



From an ecological perspective, these land use influences have had a marked impact on the park. The level of development that has occurred outside the park, in combination with storm water management decisions that have been made as part of that development, has had a rather dramatic impact on the lakes, ponds, drainageways and associated native plant life. As shown in figure 3.6, surface water flows make their way across much of the park.

Figure 3.6 – Surface water flows through the park and related issues.



Although this surface flowage is indeed inherent to the park, development of the surrounding lands has significantly changed the hydrologic characteristics and flow rates of these water systems over the course of time. In doing so, the ecological health of the park was compromised.

Although this surface flowage is indeed inherent to the park, development of the surrounding lands has significantly changed the hydrologic characteristics and flow rates of these water systems over the course of time. In doing so, the ecological health of the park was compromised. In addition, these hydrologic changes have exasperated the propensity for on-site and downstream flooding in more recent years. In response to this, Dakota County Parks has undertaken numerous studies trying to determine the best approach to dealing with water resource management issues. The draft *Comprehensive Water Resources Management Plan* dated May of 2000 substantially moved this discussion forward. Section IV takes this one step further by defining a vision for water resources management within the park whereby some of the ecological values that have been lost can be regained while at the same time resolving the ongoing on and off-site stormwater management issues addressed by the noted management plan. Although many of the land use decisions will permanently affect the water systems within the park, the master plan seeks to create a vision for the park that is both implementable and sustainable.

Trends in the Quality of Ecological Resources

The field research and analysis conducted throughout the park have documented the current condition of the localized ecology. Unfortunately, many of the ecological systems exhibit significant degradation and are in a continuing state of decline. As with most urbanized areas in the Midwest, these same transitions are found throughout the region.

Left unchecked, current ecological trends within the park will continue on a downward trend in terms of overall ecological health. The challenge becomes reversing these trends through ecological restoration and management programs.